Economic Background on Interior's Oil and Gas Policy

Introduction

The Administration announced changes in January 2010 to the Department's oil and gas leasing policies. The changes that will be implemented by the Bureau of Land Management (BLM) are intended to assure balanced multiple use management for land, water and wildlife, and to reduce potential conflicts that can lead to costly and time-consuming protests and litigation of leases. These reforms include:

- Site-specific reviews for individual lease sales;
- Emphasis on leasing in areas already developed;
- Greater leadership and public involvement in planning for new developments; and
- Avoiding the use of categorical exclusions from new analyses for cases involving impacts to protected species, historic or cultural resources, or human health and safety.

The reforms support the BLM's multiple-use mission: management of public lands for recreation, conservation, and energy development. Increased public participation and more thorough environmental review are expected to reduce the number of protests filed, enhance BLM's ability to resolve protests prior to lease sales, and provide more certainty for industry.

This paper provides additional information and analysis on the external market forces that impact the different aspects of the Department's oil and gas leasing program.

Background – Economics of Oil and Gas

World oil markets: According to EIA, the United States is the second-highest producer of oil, and holds about 4 percent of the one trillion barrels of global proved oil reserves.[1] Production from mature fields in North America has been declining, though new technology increases development of new oil fields, and more complete production from existing fields. Nevertheless, the United States is a relatively small player compared to the Mideast, which controls two-thirds of global reserves. Saudi Arabia is the world's leading producer, having increased production to make up for the loss of Iraqi and Kuwaiti oil in 1990. In the early 1980s, Saudi Arabia actively adjusted production to regulate global supply and demand. Since 1985, when Saudi Arabia stepped out of this balancing role, global markets have been subject to large fluctuations in times of shortage or oversupply, such as the price crash in 1986. Saudi oil production is constrained to some degree by OPEC.[2]

The industrialized OECD countries account for nearly two-thirds of global oil consumption, with the United States and Canada using nearly 3 gallons per person, per day, and the rest of the OECD using about 1.4 gallons per person, per day.[3] Non-OECD countries use about 0.2 gallons per person, per day, but demand in non-OECD countries is growing at about three times the OECD rate.

[1] Proved reserves are an estimate of oil that can be produced from known reservoirs.
[2] OPEC member countries currently include Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.
[3] High consumption in the United States and Canada is related to the common use of personal vehicles for traveling long distances.

Natural gas markets: U.S. imports of natural gas were very low up until 1986, and have been increasing since then. In 2008, imports met about 13 percent of U.S. demand. About 90 percent of 2008 imports came by pipeline from Canada; the remaining 10 percent came by liquefied natural gas (LNG) tankers from various countries.

Natural gas is moved from producing fields to processing plants, and then delivered to consumers, or stored in underground geologic features at about 400 sites throughout the country. Stores are increased in spring and summer months, and withdrawn to meet peak heating needs from November through March. In 2008, stored gas represented about 15 percent of annual consumption.

EIA has allocated 2008 U.S. natural gas consumption to several sectors:

- Electricity generation (29%);
- Residential and commercial, for heating, cooling, cooking, etc. (34%);
- Industrial, for heating, power, or as a raw material for paints, fertilizer, etc. (29%); and
- Oil and gas industry operations and pipeline fuel (9%)

Natural gas prices: Consumer prices reflect both the commodity cost of the gas itself, and the transmission and distribution costs of moving the gas from the field to the consumer. Several factors may contribute to high gas prices, including

- Colder weather;
- Increased demand by electric generators;
- Production disruptions (e.g., Gulf of Mexico hurricanes);
- Fluctuating imports; and
- High oil prices.

Gas prices can differ greatly by State, reflecting differences in pipeline infrastructure, proximity to production, average consumption per residence receiving service, and the degree of competition and regulation. Prices in the Southeast may be double the price in other areas.

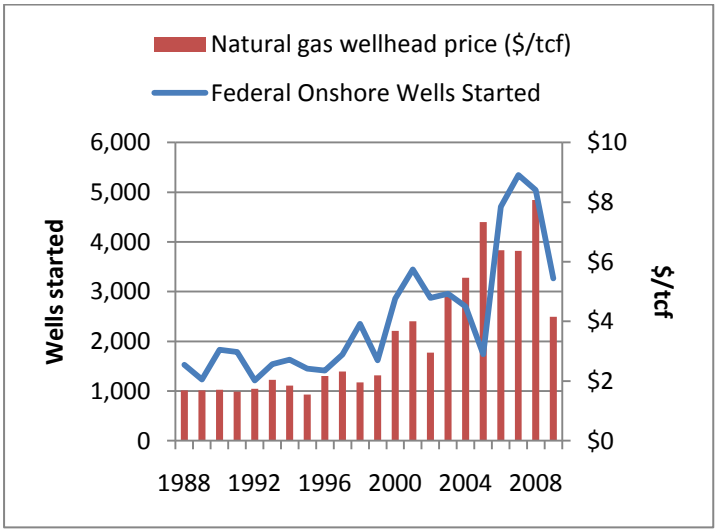

Figure 1. Annual Natural Gas Prices and Wells Drilled, 1988-2009
Source: BLM data, EIA data

Price cycles can result from producers responding to price changes. In 2008, natural gas prices began a rapid decline, falling from $10.82 in June 2008 to $2.92 in September 2009. Lower prices led to a steep decline in gas drilling (see Figure 1), which ultimately will slow production. Economic recovery in the United States will lead to increased industrial gas demand, which will spur prices until production can respond again.

Demand side: There are limited options for substituting away from the petroleum products we rely on for energy, transportation, heating, industrial raw materials and other uses of oil. This "inelastic demand" implies that consumption levels are fairly fixed in all but the very long-term.

Empirical analysis has found that changes in oil prices have a small (and often insignificant) effect on demand for crude oil, especially in the short run. In the longer run, demand is more responsive to price changes given the possibility of substitution and energy conservation, but responsiveness is still quite low. Analysis has also found that oil demand is more responsive to national income than prices and differences exist in estimated income elasticity across countries and/or regions with developing countries exhibiting higher income elasticity than OECD nations.

Supply side: The responsiveness of supply to oil prices has also been found to be low, especially in the short-term. On the one hand, producers do not necessarily increase production in the face of a price rise. On the other hand, prices may fall, but as long as they remain above a certain threshold, producers continue supplying as planned. Figure 2 shows that U.S. oil production has been trending downward over the past two decades, while oil prices have been fairly steady or rising.

There are several reasons why oil production levels are slow to change:

- It takes several years to explore and develop a new oil field;
- There is little spare production capacity to bring on-line when prices rise;
- Petroleum reserves can be used to increase supply when prices rise, though this is costly;
- There is little flexibility or substitutability in oil production methods. Most oil produced requires a certain level of exploration, drilling, pumping, transportation and refining. Price increases may spur additional investment in capital, exploration or infrastructure, but marginal upstream investments typically result in little additional oil coming to the market.

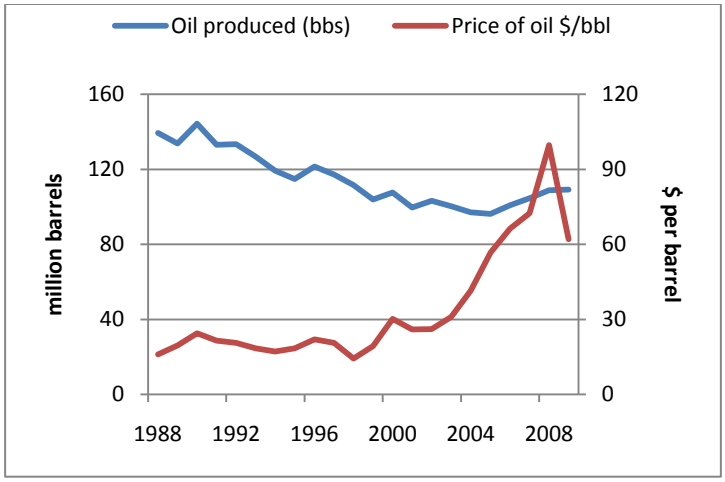

Figure 2. U.S. Oil Production and Price, 1988-2009
Source: EIA data

In general, an increase in oil prices will stimulate exploration and development. However, supply depends on the complex interaction of geological factors (reserves, depletion, discovery), economic factors (oil prices, the depletion effect, lags and leads, market structure, technical change), regulatory factors (the fiscal system) and political factors (sanctions, OPEC and political turmoil). Supply is also subject to disruption by weather and accidents anywhere along the supply chain.

The oil shocks of the 1970s caused prices to increase. Over time, higher prices reduced demand through energy conservation, fuel switching, and other means. Meanwhile, oil production increased in non-OPEC countries, as high prices made previously uneconomic wells profitable, and increased exploration revealed new reserves.

Oil prices and GDP: Many studies have documented an inverse empirical relation between oil prices and aggregate economic activity. The economy has become progressively less oil-intensive since the 1970s, with increased efficiency in transportation, heating, electricity and other oil-use sectors. This suggests that the case for significant macroeconomic impacts of oil-price increases becomes harder to make.[4]

U.S. demand for petroleum fell from an initial peak of 18.8 million barrels per day (MBD) in 1978 to 15.2 MBD in 1983 following the second major oil price shock; since then it has grown steadily with the general expansion of the economy, increased demand for travel, and so on, and is now around 20 MBD. However the petroleum intensity of GDP has almost halved in the last 30 years, down from 1.5 barrels per thousand dollars of (real) GDP to 0.8 barrels in 2000, with improved energy efficiency and a shift away from oil in the electricity sector. Declining oil intensity means that the effect of oil price changes on the economy is significantly less in relative terms than in the 1970s.

Exploration: The incentive to invest in exploration and development is directly determined by expected earnings, which is determined in turn by the market price of oil. Thus, there is a relationship between the number of wells drilled and prices. While the total number of onshore and offshore exploratory wells drilled annually since the late 1990s has trended upward, the industry is becoming more selective in its choice of which exploratory wells to drill. Figure 3 shows exploration and development expenditures against crude oil prices, which have been trending upwards together since the late 1990s.

In general, the preference is toward more expensive wells and toward prospects that have a greater probability of a payoff. The trend toward more expensive exploratory wells is most evident in offshore activity. Figure 1 shows the number of total number of wells drilled, onshore wells drilled, and the natural gas wellhead price. As price rises, drilling activity increases. The same general pattern holds for wells drilled and crude oil prices.

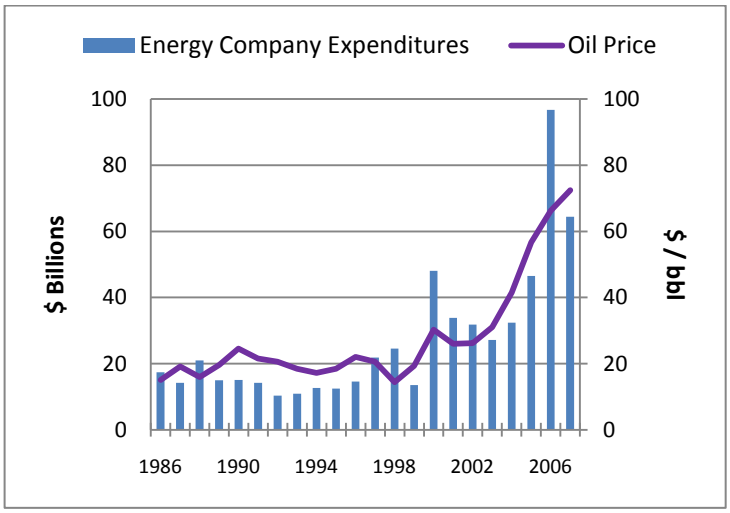

Figure 3. Major U.S. Energy Companies' Expenditures for Crude Oil and Natural Gas Exploration and Development
Source: BLM data, EIA data

[4] Brown and Yücel (2002) investigated the long-term oil price-GDP relationship, noting that the "sensitivity of the U.S. economy to oil price shocks seems to have decreased over the past two decades." Ian W.H. Parry and Joel Darmstadter, 2003. The Costs of U.S. Oil Dependency Resources for the Future Discussion Paper 03–59.

Technology changes: Worldwide production of oil by major companies declined in 2008, while worldwide production of natural gas increased. The decrease in oil production continues a decades-long trend, as companies have shifted their focus to natural gas. Production of natural gas in the United States has grown faster than overseas production since 2006, in part, because of the surge in unconventional coal-bed methane and shale gas production in the United States.

Technology changes over the past 20 years have improved oil and gas finding rates, mitigated declining productivity in existing fields, and helped lower exploration and development costs. These technology changes include the use of 3D seismic surveys, directional drilling, deepwater technologies, and technologies to improve the recovery of oil and gas from existing wells, and have improved the competitive position of the U.S. petroleum industry in the world market. Although innovation lowers production costs and raises output relative to what it would have been, these technologies are not likely to have a major impact on the world price of oil.[5] The new technology is not applied to all production; the increase in production and the decrease in price are too small to noticably impact world prices.

Externalities: The price of oil may not adequately reflect costs associated with a number of items including the following:

- Energy security;
- Reduced spending on protecting overseas supplies;
- Disturbance of overlying areas; and
- Pollution related to extraction, transporting and refining.

[5] Bohi, Douglas. 2008. Changing Productivity in U.S. Petroleum Exploration and Development. Discussion Paper 98-38, Resources for the Future, Washington, D.C.

Potential Impacts of Market Forces on Interior's oil and gas program

This section presents additional information on how external market forces, such as the price of oil and gas, relate to several key aspects of leasing activity on public lands: royalty revenues, production, and number of lease sales, lease sales revenues, and finally acres leased.

Royalty Revenues

Prices

Royalty revenues can fall when prices or production (or both) fall. Oil prices *fell* from a 2008 average of $99.75 per barrel[6], to a 2009 average of $62.09 per barrel. Likewise, natural gas prices fell from a 2008 average of $8.90 per mmBTU[7] to $4.16 per mmBTU. These price changes affected all producers, not just those on Federal lands.

Figure 4 and Figure 5 show oil and natural gas royalties, and prices. As prices increase, royalty revenues increase; as prices fall, royalty revenues fall. There is a similar relationship between bonus bids and oil prices and between bonus bids and the number of acres leased competitively.

Figure 8 shows onshore bonus bids and oils prices over the 1988-2009 period. Bonus bids track prices reasonably well.

Federal mineral revenue data indicate a 47% decrease in Inter-Mountain oil and gas revenues[8] between 2008 and 2009.[9] However, non-royalty revenues (rents, bonuses and "other revenue") showed an *increase* of 47% over this period.

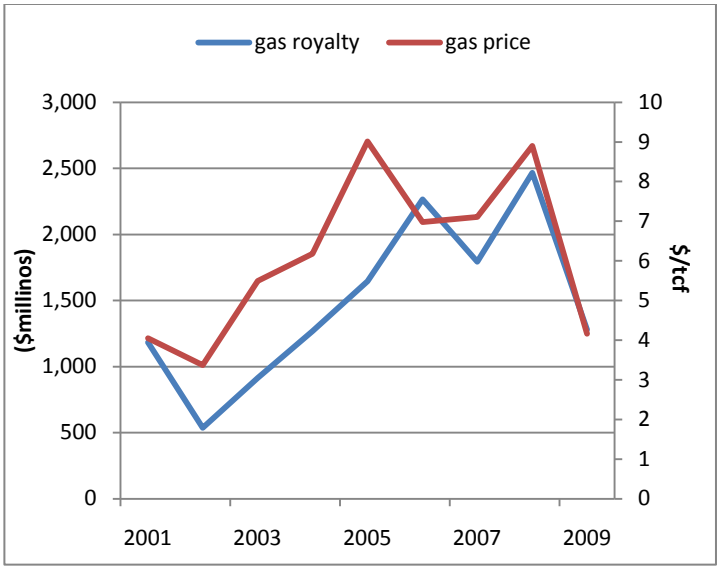

Figure 4. Onshore Natural Gas Royalties and Prices, 2001-2009
Source: BLM data

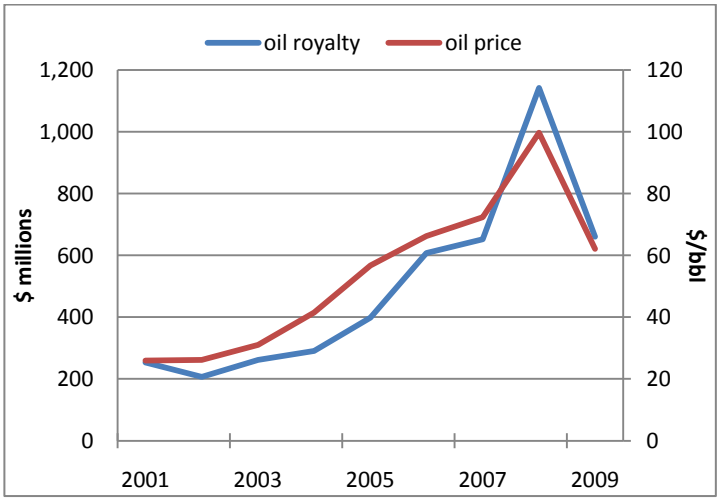

Figure 5. Onshore Oil Royalties and Oil Prices, 2001-2009
Source: BLM data

[6] Cushing, OK Crude Oil Future Contract 1
[7] Natural Gas Futures Contract 1
[8] Oil and gas revenues for Colorado, Montana, New Mexico, Utah and Wyoming, including rents, bonuses, "other revenue," and royalties on oil, processed gas, unprocessed gas, gas plant products, and condensate.
[9] Data from BLM

Production

U.S. total oil production has been declining since the mid-1980s (see Figure 2). This is unsurprising given the long history of oil extraction in the United States.[10] In contrast, lower-valued natural gas production was increasing from the mid-1980s to 2000, followed by a down-trend in 2000-2005, and a sharp up-trend since 2005.

Federal onshore and offshore oil production has increased 14% over the last year, from 476.6 million barrels in 2008 to 544.3 million barrels in 2009.[11] EIA reports total U.S. oil field production of 1.9 billion barrels for the last twelve months,[12] up 5.5% from 1.8 billion for the previous twelve-month period.

There is a difference between temporary supply increases from limited-lifetime wells extracting a nonrenewable resource from a highly depleted base and enduring demand reductions based on oil efficiency improvements and alternative fuels substitution permanently weaning the economy off oil.

[10] The effects of falling production can be offset to some degree by falling demand.
[11] Data from Minerals Management Service.
[12] EIA "U.S. Field Production of Crude Oil" for November 2008 through October 2009.

Number of Lease Sales

Table 1 shows bonus revenues in 2008 and 2009. Bonus revenues in 2008 were about eight times those of 2009, with the difference due to a substantial fall in offshore bonuses. The $10 billion figure cited for 2008 includes offshore bonuses of $9.5 billion[13] and onshore bonuses of $0.7 billion. For 2009 the total was $1.3 billion, including $0.8 billion in onshore bonuses, and $0.5 billion offshore.

FY 2008 was an extraordinary year for Federal oil and gas bonus revenues, as shown in Figure 6.

Part of the explanation was high prices.[14] At the beginning of FY 2008, oil and gas prices started climbing, peaking during summer of 2008, then fell precipitously.[15]

FY 2009 represents the median year since 2001: four years showed higher oil and gas bonus revenues, and four years showed lower revenues. Figure 7 shows that onshore bonus revenues for FY 2009 were at their highest level since 2001. Figure 7 shows federal bonus revenues for on and offshore oil and gas. This figure illustrates that FY 2008 was an unusual year for offshore bonus revenue. Changes in bonus bids closely track changes in oil (and gas) prices, as shown in Figure 8.

Table 1. Federal Oil and Gas Bonus Revenues ($ billions)

	Offshore	Onshore	Total
FY 2008	9.5	0.7	10.1
FY 2009	0.5	0.8	1.3

Source: data from MMS 2001-Forward MRM Statistical Information

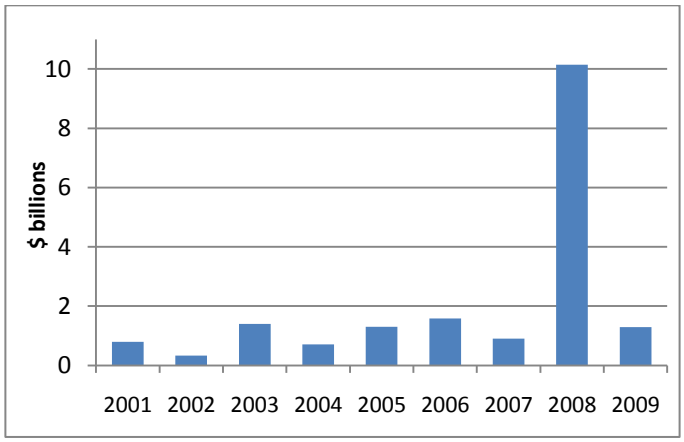

Figure 6. Federal Oil and Gas Bonus Revenues, FY 2001-2009
Source: data from MMS 2001-Forward MRM Statistical Information

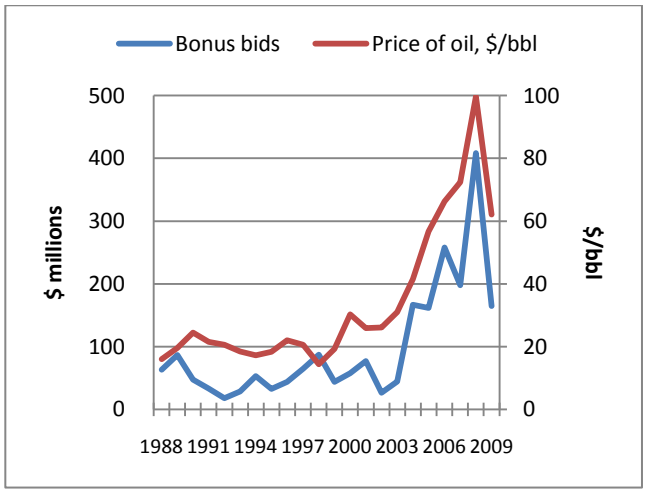

Figure 8. Onshore Bonus Bids and the Price of Oil, 1988-2009
Source: BLM data, EIA data

[13] The high level of bonus bids received in FY 2008 appears to be partially a function of high oil prices and the perceived quality of the leases available for bidding.

[14] Another part of the explanation is the availability for leasing of parcels with high hydrocarbon potential in 2008.

[15] While 2008 exhibited an extraordinarily large price swing, volatility in oil prices is ordinarily quite high because the underlying demand and supply curves are so inelastic. Demand is inelastic due to long lead times for altering the stock of fuel-consuming equipment. Supply is inelastic in the short-term because it takes time to augment the productive capacity of oil fields. The steep ascent in the price of oil between 2004 and 2008 coincided with the first significant decrease in non-OPEC supply since 1973 and an unprecedented surge in global demand. Although OPEC members responded by increasing their production, they lacked sufficient capacity after years of restrained field investments to bridge the growing gap between global demand and non-OPEC supply (Smith, James L. *The 2008 Oil Price Shock: Markets or Mayhem?* Resources for the Future Commentary, November 6, 2009).

Bonus bids can also be affected by the number and quality of acres offered. The number of onshore acres leased appears more strongly affected by prices for natural gas than oil, likely because BLM areas available for leasing are considered better for producing natural gas than oil. Gas prices dropped considerably starting in summer 2008, and have stayed fairly low since then. If gas prices were to rise, it is anticipated that more Federal acres would be leased if they were offered.

Lease Sales Revenues

Lease sales revenues have increased in recent years and do not appear to be directly impacted by changes in Interior's leasing policies. According to MMS (2001-Forward MRM Statistics) and BLM data, onshore leases netted $254 per acre in 2008, and $418 per acre in 2009. As shown in Table 2, this is the highest bonus-per-acre figure since 2001.

Table 1. Bonus Dollars per Onshore Acre Leased

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY2006	FY 2007	FY2008	FY2009
Onshore Bonus ($ million)	166	193	252	185	733	720	529	664	800
Acres Leased (millions)	4.0	2.8	2.1	4.2	4.3	4.7	4.6	2.6	1.9
$ per Acre	42	69	122	45	170	154	114	254	418

Source: BLM data

Number of Acres Leased

Figure 9 shows the annual number of onshore acres offered for lease by the Federal government since 1988, as well as the acres leased. The number of acres offered for lease each year has declined from nearly 15 million in 1988, to about 4 million in 2009. The lowest number of acres offered was 2.5 million in 2001. Meanwhile, the number of acres leased each year has remained between 1 and 3.8 million acres over this period. The lowest annual number of acres leased was 1 million in 1992.

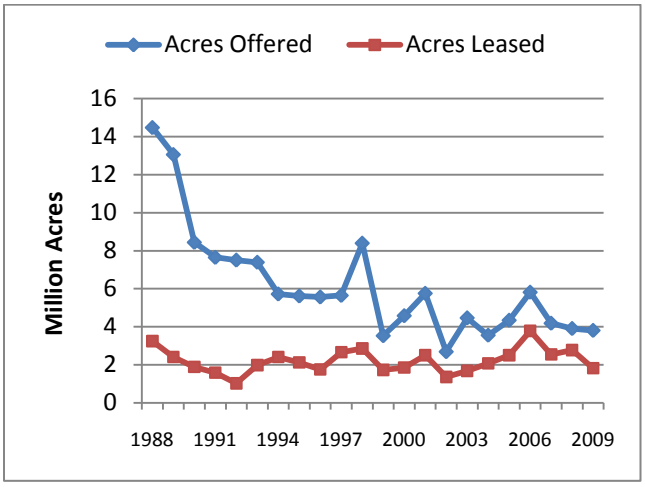

Figure 9. Onshore Acres Offered and Sold, 1988-2009
Source: BLM data

Figure 10 shows the total number of acres under lease from 1984 to 2009. Total acres under lease fell from about 130 million in 1984 to about 33 million in 1996. Although new acres leased in 2009 (about 2 million) was fairly low, the total acreage under lease was 45.4 million. This represents the second highest level since 1993.

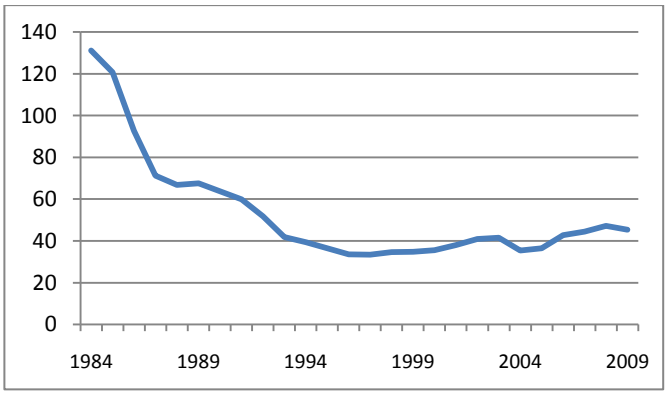

Figure 10. Onshore Oil and Gas Acres under Lease, 1984-2009
Source: BLM data